

Applicant: Hugh P. Craig
Serial No. 09/242,388
Filed: February 16, 1999
Docket: 2740.2.1 (1118-3)
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19. (Amended) A composition comprising in admixture:

(i) a metallic powder component which includes (a) a solder powder and

(b) a metal powder melting at a higher temperature than the solder powder;

(ii) a polycarboxyl compound effective as a fluxing agent for the metallic powder component at a first temperature and as a cross-linking agent for an epoxy resin at a higher second temperature, the polycarboxyl compound being selected from carboxylated polymers, polycarboxylic acids as such and polymer fatty acids so as to provide multiple reaction sites, the composition being applied to a dielectric substrate to which an epoxy resin has been pre-applied.

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REMARKS

In the Office Action dated January 29, 2001, the Examiner has affirmed the election to prosecute the subject matter of claims 1-39, indicating that claims 40-56 are withdrawn from further consideration as being drawn to non-elected subject matter. Furthermore the Examiner has rejected claims 1-39 under 35 U.S.C. § 102(b), alleging that it is anticipated by the disclosure of U.S. Patent No. 5,376,403 to Capote, et al.

In response to the Office Action, Applicants have undertaken to amend the claims, which, when considered together with remarks set forth herein, are deemed to place the case in condition for allowance. As a result of the present Amendment, claims 1-39 remain before the Examiner for purpose of continued prosecution.

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The present invention is a composition used to produce metal traces for printed circuit boards, wiring boards and the like. The composition and combination circuit board and composition include a metal powder, a solder powder, a polymer or a monomer which is polymerisable to yield a polymer, such polymer being cross-linkable under the action of a chemical cross-linking agent. Furthermore, and importantly, the present invention also includes a chemical cross-linking agent for the polymer, such cross-linking agent having fluxing properties and being unreactive with the polymer in the absence of catalysis. The cross-linking agent is a polyacid; i.e., it can be selected from carboxylated polymers, polycarboxylic acids as such, and polymer fatty acids whereby multiple reaction sites are provided for cross-linking action.

The Examiner has rejected all of the claims under 35 U.S.C. § 102(b), contending that it is anticipated by the disclosure of U.S. Patent No. 5,376,403 to Capote, et al. In so doing, the Examiner has contended that since Capote, et al. disclose electrically conductive adhesive compositions and methods for their preparation which include a solder powder, a chemically protected cross-linking agent with fluxing properties and a reactive monomer or polymer, the reference discloses and clearly anticipates every claim. Applicants respectfully disagree with the Examiner's analysis, and request reconsideration of the claims and allowance based on the amendment to the claims and the analysis set forth herein.

U.S. Patent No. 5,376,403 to Capote, et al. discloses an electrically conductive adhesive composition which includes a solder powder, a chemically protected cross-linking

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agent which also serves as a fluxing agent. This disclosure does not teach nor suggest the chemical composition of the present invention. Capote, et al. require as an essential feature the use of a chemically protected cross-linking agent with fluxing properties. The Capote, et al. cross-linking agent is chemically protected to ensure that it cannot act as cross-linking agent under, for example, storage conditions. Not only is this disclosure not anticipatory of the present invention, it actually teaches away from the present invention.

yes it does
cause, but
claim non-
reactive
w/o heat

In the present invention, a polymer or monomer which is polymerisable to yield a polymer can be crosslinked under the action of a chemical cross-linking agent. The cross-linking agent of the present invention is unprotected chemically – yet it is nonreactive with the polymer in the absence of the application of heat and catalysis. This is contrary to the disclosure and the teachings of the Capote, et al. '403 reference. To that end, the cross-linking agents of the present invention are polyacid in nature and are selected from carboxylated polymers, carboxylic acids and polymer fatty acids which provide multiple reaction sites for cross-linking.

protective or
non
is not claimed

This essential feature is quite contrary to the teachings of the Capote, et al. '403 reference. In the Capote, et al. '403 reference, heat is used to activate the chemically protected cross-linking agent by removing the chemical protection. Chemical protection is achieved in the Capote, et al. technology by, *inter alia*, esterification; and the removal of such protection results in the generation of alcohols. Consequently, the alcohols generated by Capote, et al. are a substantial part of the adhesive, and their presence affects the processing

does not
exclude
alcohol
product

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and effects the performance of the product made from the Capote, et al. composition. For example, processing for the Capote et al. '403 composition require an involved thermal profile which includes curing at 215°C and postcuring at 150°C. These conditions promote the formation of intermetallic compositions known to degrade the performance of electrical conductors and interconnects by both increasing the resistance to current flow and embrittling the trace. This problem is exacerbated by the additional thermal processing required to produce electronic assemblies. These problems have been surmounted using the compositions of the present invention.

single
process
steps

The present system is quite contrary to the Capote, et al. '403 teaching in that there is no requirement for chemical deprotection as required by Capote, et al. The only mention of a carboxylic compound in connection with a cross-linking agent in the Capote, et al. '403 reference has to do with esterified carboxyl groups of relatively low molecular weight compounds which must be de-esterified during processing. As clearly described above, this leads to an inferior product which cannot be processed as simply as the claimed composition; nor does the Capote, et al. composition operate electrically as efficiently as the present invention.

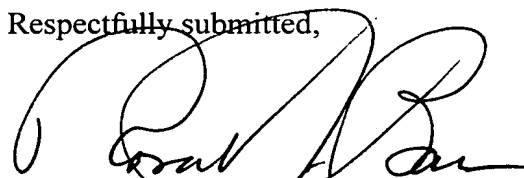
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In order to emphasize the distinction over carboxylic acids which have been esterified, the independent claims have been amended by adding the term "as such" as a modifier to the term -- polycarboxylic acids --.

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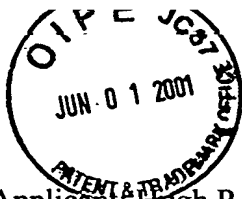
In view, therefore, of the Amendment to the claims, as well as the analysis set forth above in the Remarks, it is firmly believed that the present application is in all respects in condition for allowance, which action is earnestly solicited.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Ronald J. Baron', written over a horizontal line.

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VERSION OF AMENDMENT WITH MARKINGS
TO SHOW CHANGES MADE IN THE CLAIMS

IN THE CLAIMS:

Please amend Claims 1, 18 and 19 as follows:

1. (Amended) A composition of matter comprising:
 - (a) a metal powder,
 - (b) a solder powder which melts at lower temperature than the metal powder,
 - (c) a polymer, or a monomer which is polymerisable to yield a polymer, said polymer being crosslinkable under the action of a chemical cross-linking agent,
 - (d) a crosslinking agent for said polymer, the crosslinking agent being selected from carboxylated polymers, polycarboxylic acids as such and polymer fatty acids so as to provide multiple reaction sites, the crosslinking agent having fluxing properties and being nonreactive with said polymer without the application of heat and provision of a catalyst for reaction therebetween, the crosslinking agent, as such, not reacting with said polymer under storage conditions, and the crosslinking agent being capable of solvating
 - (e) metallic oxide and metallic salt catalysts which are formed by heating metallic components (a) and (b) and which promote a rapid crosslinking reaction between said polymer (c) and said crosslinking agent (d) when incorporated in said polymer, as a result of solvation by the crosslinking agent in the presence of heat.

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18. (Amended) A composition for application to a dielectric substrate in a predetermined pattern and comprising, in admixture:

(i) a metallic powder component which includes (a) a solder powder and (b) a metal powder melting at a higher temperature than the solder powder;

(ii) a polycarboxyl compound effective as a fluxing agent for the metallic powder component at a first temperature and as a cross-linking agent for an epoxy resin at a higher second temperature, the polycarboxyl compound being selected from carboxylated polymers, polycarboxylic acids as such and polymer fatty acids so as to provide multiple reaction sites, and

(iii) an [a] epoxy resin.

19. (Amended) A composition comprising in admixture:

(i) a metallic powder component which includes (a) a solder powder and (b) a metal powder melting at a higher temperature than the solder powder;

(ii) a polycarboxyl compound effective as a fluxing agent for the metallic powder component at a first temperature and as a cross-linking agent for an epoxy resin at a higher second temperature, the polycarboxyl compound being selected from carboxylated polymers, polycarboxylic acids as such and polymer fatty acids so as to provide multiple reaction sites, the composition being applied to a dielectric substrate to which an epoxy resin has been pre-applied.